

White Paper  
National Endowment for the Humanities

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**Improving the Physical Environment in  
Spencer Research Library**

October 2016 – March 2018

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## **1. Project Activities**

The National Endowment for the Humanities awarded the University of Kansas Libraries a grant of \$50,000 under the Sustaining Cultural Collections program to engage consultants from Image Permanence Institute (IPI), Rochester Institute of Technology, for an 18-month period to collect and analyze data on the environmental conditions within the Kenneth Spencer Research Library collection storage and staff areas. The consultants were required to report results of their research and recommendations at the end of the contract period. The University of Kansas Libraries assembled an Environmental Management Team to engage in a thorough planning process with the IPI consultants in order to identify problems and determine feasible, cost-effective, and environmentally sustainable solutions for the fifty-year old Kenneth Spencer Research Library and its heating, ventilation, and air-conditioning (HVAC) system, dating from construction. The ultimate goals of the project were to better preserve the collections and the facility itself while, if possible, reducing the environmental impact of the building's operations. The project proceeded smoothly during the entire grant period, with no omissions or significant changes to the proposed plan. The consultants planned three visits to the University campus to evaluate the building and its HVAC system and to communicate with University staff from the physical plant and the Libraries. Robust communication ensued among Library and University staff and the consultants throughout the contract period.

The Environmental Management Team assembled by the Project Investigators consisted of representation from Facilities Services, Campus Operations, Center for Sustainability, KU Libraries, Facilities Planning and Development, and the Department of English. Team members from Facilities Services, Facilities Planning and Development, and the Libraries were most active in communicating and exchanging information with the consultants. The strength of a broad team was highlighted as each participant brought unique insights to the developing analysis based on their knowledge of the building, its systems, and University policies and procedures.

## First Visit, October 2017

On October 23-25, 2017, KU Libraries hosted IPI consultants Christopher Cameron and Kelly Krish. The first visit allowed the consultants to tour the spaces, to listen to participants' concerns about how the building's environmental systems impacted collections storage, and to install dataloggers at additional locations beyond those previously placed by the Libraries in order to better understand operation of the mechanical systems. Facilities staff led a tour of Spencer Library's mechanical room, pointing out how the system functioned, and, in particular, which components were the most challenging to maintain.



*Left: Entering Spencer Research Library's mechanical room.*

*Right: Kelly Krish and Christopher Cameron in the supply air area, with filters to the left.*

The consultants also met separately with collections staff, walking the stacks and taking notes on anomalies in temperature, humidity, light, and other environmental issues. They asked many questions and took copious notes. They also used an infrared (IR) detection unit in order to record hot and cold spots in the stacks. The IR images confirmed the anecdotal evidence that some of the vents

were not functioning properly. In fact, in some stacks areas, some vents were producing chilled air while others simultaneously produced heated air.



*Left: Kelly Krish and Christopher Cameron interview Spencer Library stacks manager Meredith Huff to learn about environmental concerns in the stacks.*  
*Right: Using an infrared camera to determine hot and cold spots in the stacks.*

After discussing concerns with collections staff, Cameron, Krish, and Head of Conservation, Whitney Baker, discussed where additional dataloggers should be placed in order to supplement five years of data from thirteen loggers in Spencer Library. They added loggers into the air handling unit, vents, and in collections spaces not previously monitored in order to gain a better overall view of the climate in Spencer Library. Spencer Library staff took monthly data readings for a total of twenty-three loggers in the Spencer stacks, vents, and mechanical systems throughout the eighteen-month project, uploading data into eClimate Notebook software designed by the Image Permanence Institute.

## **Second Visit, April 2018**

After an early-April conference call to set the agenda for the second visit, Cameron and Krish met with members of the KU team representing Facilities Services, Campus Operations, KU Libraries, and Facilities Planning and Development on April 24-25, 2018. Since the previous visit, the Libraries had installed some new windows in the North Gallery of Spencer Library, exposing stacks areas to unexpected condensation and radiation issues. We also discussed the seasonal shutdowns that had been implemented between visits 1 and 2 with the result that the HVAC system operated in an overnight setback mode for thirteen hours at a time to save energy. The building maintained temperature and relative humidity at acceptable levels over the winter months through this energy-saving mode.

The consultants checked the data and once again toured the mechanical room and stacks. The team ended the visit by discussing the data, making plans for some controlled studies of setbacks for shorter periods of time, and discussing how we might use some designated grant funds to conduct further testing or make small improvements to the system.



*Whitney Baker (left, KU Libraries) confers with Christopher Cameron and Kelly Krish of IPI*

### **Conference Calls and Additional Testing**

In June 2018 team members participated in a conference call about the thirteen-hour overnight shutdowns that had been established. The data indicated that the building could not maintain temperature and relative humidity in the space at nights beginning in late April, and did not recover acceptable levels of temperature and relative humidity throughout the day. After discussion with campus energy engineer, George Werth, we all agreed to modify the shutdowns for a shorter period of time, starting in later hours when the heat load had somewhat dissipated. The team would check in after one week to see the results of the data. After that time period, the data indicated that the building systems could not recover after the day-time settings were activated. The summer shutdowns were discontinued at this time, and resumed in the fall after the hottest and most humid summer months had passed.

After discussion with the consultants and approval from NEH, we agreed to use the funds earmarked in the grant for additional equipment to install temperature and relative humidity sensors in

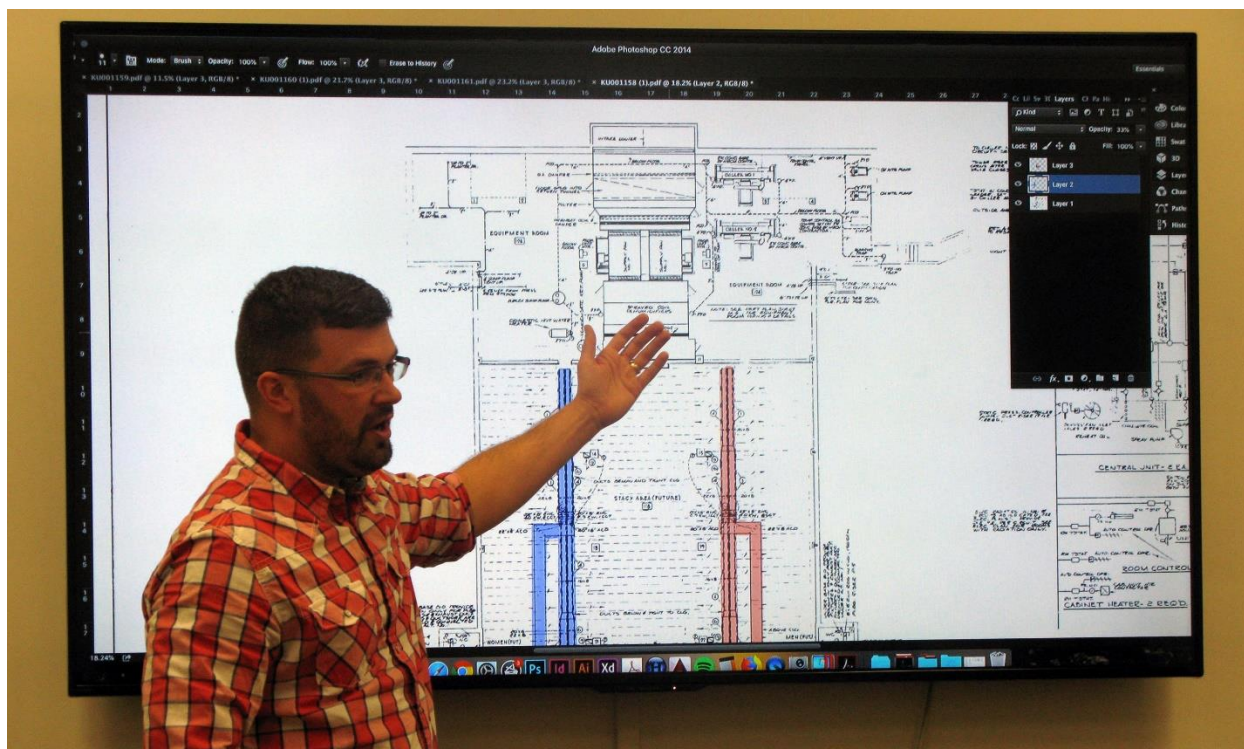
Spencer Library to supplement the two in the building, both of which were located in the return air streams in the machine room. We hoped that by installing additional sensor points in the collections stacks the campus energy team could have a better sense of how the air handling unit in Spencer Library functioned and would be better able to respond to anomalies. In October 2018 two sensors were installed on each of the four floors of Spencer Library in collection storage areas. (University of Kansas Libraries and the grant funding shared the cost of the eight sensors and the installation fee.)

### **Third Visit, December 2018**

On December 4-5, 2018, Cameron and Krish met in person with members of the KU team representing Facilities Services, Campus Operations, KU Libraries, and Facilities Planning and Development. We first met to discuss building and mechanical system updates since the April visit, such as the opening of a new conservation lab and work on windows in Spencer Library's North Gallery. In order to design a cycle of temperature and humidity settings for Spencer, the group discussed weather conditions in Lawrence, Kansas, during the spring, summer, and fall.

As in past visits, the consultants collected data from dataloggers placed in the mechanical system, vents in the collections stacks, and in open spaces in the stacks. They then spent time analyzing the data and searching for anomalies to be addressed. On the second day, the consultants met with the Environmental Management Team to discuss the conclusions that resulted from the 18-month study of Spencer Research Library, utilizing climate data gathered over that period in eClimate Notebook software. We also discussed ways to improve the sustainability of our system, which currently consumes excessive energy. The consultants showed us architectural drawings for the airflow throughout the building in order to suggest how our HVAC system might be updated to provide separate zones for collections and people.





*Chris Cameron explains how air travels from the air handling unit through two underground channels, which provide air to the east and west sides of the buildings. The findings indicated that the air temperatures vary slightly but consistently on the east and west sides of the building.*

## Major Findings and Recommendations

The consultants submitted their final report in March of 2019. They noted that the summers in Lawrence, Kansas, have high temperatures and high moisture; aiding the Spencer Library in overcoming those two conditions would lead to the greatest impact in preservation quality of the environment. The other three seasons, on the other hand, offer the greatest opportunities for energy-savings operations by taking advantage of the environment and experimenting with seasonal shutdowns.

The consultants reported, “the dewpoint that the mechanical system is currently capable of achieving does not allow for the lower temperatures with controlled relative humidity that are needed for long-term preservation of collection materials.” They noted that the fifty-year old system relies on pneumatic sensors with downstream reheats that are complicated, hard to service, unsustainable, and



expensive to maintain. It is nearly impossible for facilities staff to regularly service so many reheats in the large building, so energy saving opportunities are limited on that front. In addition, they pointed out that the building envelope is not designed to facilitate the level of climate control that we are seeking, resulting in the loss of conditioned air to the outside and requiring that the system work harder, using more energy, to maintain conditions. On top of that, because there is only one zone in the building, it is challenging to set preservation standards for collection storage spaces that would be significantly cooler than occupied spaces.

In addition, they noted that film to block ultraviolet radiation that was installed in the North Gallery and conservation lab was not functioning as designed. Shades designed to lower visible light levels in the North Gallery were not consistently used, while other windows in the North Gallery exhibit space did not have shades as they should. Finally, they found that lights in some of the collection storage spaces were routinely left on when staff left those rooms, resulting in unnecessary light exposure to sensitive collections.

To that end, the consultants made various recommendations. In the short-term they encouraged us to add water alarms to below-grade collection spaces, implement light mitigation strategies, correct excess heating situations where radiant heaters and thermostats are malfunctioning, and continue testing of modified shutdowns, both in summer and winter months.

The consultants also offered long-term recommendations, such as 1) installing a building management system (BMS) throughout the building so the campus facilities team would have much more control over the system settings in various parts of the building, 2) tackling moisture and air incursions in the University Archives, on the top floor of the building, 3) eliminating standing water in the supply air tunnels to reduce excess humidity in the collection areas, 4) improving storage conditions in at least some spaces that house the most vulnerable materials, such as photographic and audiovisual collections, and 5) replacing the mechanical system.

Regarding the fifth recommendation, the consultants highlighted the challenges of the building's single-zone HVAC system that does not allow for separate zoning for collection storage and office and public use spaces. The consultants proposed two solutions that would allow the building to be zoned: 1) two separate air handling units (perhaps using some existing ductwork but requiring extensive renovation to add additional airflow) or 2) one air handling unit with downstream reheats for occupied spaces. Either solution would require significant infrastructure investment but would make major improvements in the storage environment for Spencer Library collections, while reducing operating and energy costs.

### **Publicity**

The project was publicized in a variety of ways. First, Project Co-Director Whitney Baker wrote three entries on the Spencer Library blog after each of the three consultant visits to record the progress and accomplishments of the project as they were happening. Links to the posts may be found below under "Award Products."

In addition, the project was discussed with graduate students in Baker's museum studies class, *Conservation Principles and Practice*. The timing did not work for a conference call with the consultants, but Baker explained the project's aims in detail with the students while walking through the Spencer Library spaces. In addition, the goals of the project were described in an article written for the *University Daily Kansan*, the student newspaper for the University of Kansas, and in a University of Kansas press release prepared by KU Libraries.

## **2. Accomplishments**

Certainly the main accomplishment of the grant was to bring together a collaborative team at the University of Kansas committed to sustainability. The consultants were skilled at facilitating discussion from many angles, focusing on both the building and collections. The group worked well together and brought many perspectives to the tasks at hand. The addition of eight sensors in the building, paid for in

part by using funds designated in the grant for additional testing and support, are a tangible product of the grant that has improved Spencer Library's environment.

To that end, members of the team have taken to heart the recommendations of the consultants and made adjustments while the project was underway. For one, radiators were disconnected in small collection storage spaces where temperatures reached 90 degrees Fahrenheit at times. Experimentation with seasonal setbacks has continued to improve energy savings while maintaining appropriate storage environments. Finally, a new zone maintenance manager was assigned to Spencer Library at the end of the project; he and his team have spent significant time investigating and correcting some long-standing temperature and relative humidity inconsistencies throughout the building by fixing broken reheats, opening closed dampers, and checking airflow. These changes have been welcome and noticeable.

In addition, the project Co-Directors have worked with Beth Whittaker, Head of Spencer Library, to address excess light in some spaces. Some windows had ultraviolet-blocking film that did not function as advertised; we have researched replacements. We are also investigating window upgrades in one space and the addition of shades in the North Gallery exposed stacks area. Finally, Baker presented the findings of the consultant report at a meeting attended by all Spencer Library staff, focusing on the issue of lights being left on in the stacks when no one is occupying those spaces. A thoughtful discussion ensued and Whittaker implemented some new policies that should reduce collection light exposure in some spaces.

### **3. Evaluation**

The project has not been evaluated in a formal way, as the aims of the project were quite straightforward: engage a consultant to evaluate the HVAC system and offer short- and long-term recommendations to alleviate the environmental and energy-use issues. The most significant outcome is the enhanced communication between library and facility personnel focused on making improvements

to system maintenance and settings to achieve some short-term successes. We were fortunate that none of the key personnel changed during the course of the grant project, providing a great deal of continuity.

#### **4. Continuation of the Project**

The key team members have continued to meet since the grant award period ended, with the aims of addressing some of the more thorny recommendations from the consultant report. For one, although Spencer Library systems are functioning more efficiently, the air handling unit is now over fifty years old and will have to be replaced eventually. The collaborative team has met regularly in 2019 to discuss the best approach for next steps, given the University's budget challenges and competing building needs across campus. Commitment is high for continuing the work started under this grant.

#### **5. Long-Term Impact**

We are grateful to the National Endowment for the Humanities for support of this grant that has served as a first step at improving environmental conditions in our rare books, manuscripts, and archives library. The attention paid by staff from Facilities and Campus Operations to Spencer Library has been heartening, given the sheer number of buildings on the University of Kansas campus with significant building challenges. Our commitment to improving radiation control throughout the building has already improved the collections spaces. The team assembled for this grant is committed to regular meetings into the future.

#### **6. Award Products**

The main award product is the report from the Image Permanence Institute. In addition, three blog posts have resulted from the project to date: 1) <https://blogs.lib.ku.edu/spencer/improving-the->

[physical-environment-in-spencer-library-a-first-visit-from-image-permanence-institute/](#), 2) <https://blogs.lib.ku.edu/spencer/improving-the-physical-environment-in-spencer-library-the-second-visit-from-image-permanence-institute/>, and 3) <https://blogs.lib.ku.edu/spencer/improving-the-physical-environment-in-spencer-library-the-third-visit-from-image-permanence-institute/>.